PARTICLE DEPOSITION IN THE PINON PINE HOT-GAS FILTER VESSEL

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ABSTRACT

In the pursuit of economical clean coal technologies for the 21st Century, advanced pressurized fluidized bed combustor (PFBC) and integrated gasification combined cycle (IGCC) technologies have attracted considerable attention. The success of these advanced coal energy systems hinges on effective and reliable commercial-scale filtration of gases at very high temperatures. The Pinon Pine hot-gas filtration system is one of the first industrial-scale applications of an advanced particle filtration system in the United States. The system currently is becoming operational and will provide significant practical insights into operation of the industrial-scale hot-gas cleaning process.

This study is concerned with a computer simulation of hot-gas flow and particle transport and deposition in the Pinon Pine filter vessel. The FLUENT^{TM} code is used for evaluating the gas mean velocity, mean pressure, and the state of turbulence in the filter vessel. The 748 filters arranged into four tiers are modeled as four effective cylindrical filters. The particle equation of motion that includes the nonlinear drag and the gravity is used. The particle deposition patterns are evaluated, and the effect of particle size is studied. The results show that, for clean filters, the rate of particle deposition rate of particles on different tiers depends on particle size. These differences could lead to nonuniform cake compositions and thicknesses on the candle filters in different tiers.